RHIC Polarimetery

Status

Dmitri Smirnov
RHIC Spin Group/STAR, BNL

January 14, 2011

# CNI Polarimetry at RHIC

- The mission:

  - Support H-Jet and p-Carbon polarimeters
  - Provide a reliable polarization measurement at a wide range of beam energies 24 to 250 GeV
  - Achieve presicion for polarization measurement of $< 5\%$
  - Measure beam polarization profiles
  - Polarization lifetime or decay during a store
  - Bunch emittance measurement

- Active members:

  - Igor Alekseev
  - Elke Aschenauer
  - Grigor Atoian
  - Sasha Bazilevsky
  - Alan Dion
  - Haixin Huang
  - Yousef Makdisi
  - Andrei Poblaguev
  - Bill Schmidke
  - Dmitri Smirnov
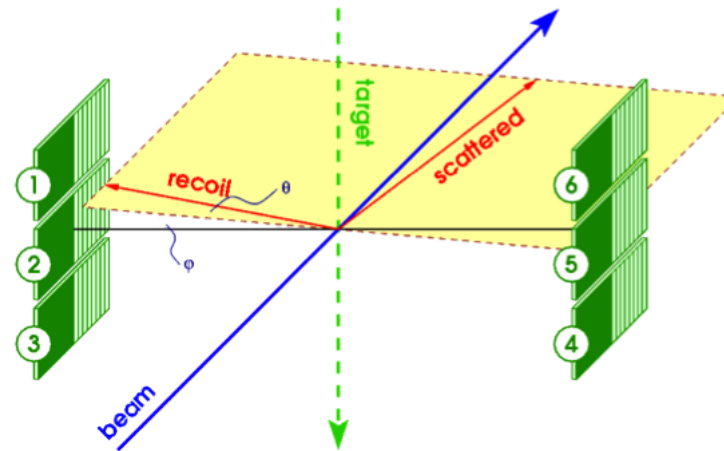 - Dima Svirida
  - Kin Yip
  - Anatoli Zelenski

- The kinematics of elastic scattering is fully defined by the recoil products

polarized
p beam

recoil
proton or
carbon

scattered
proton
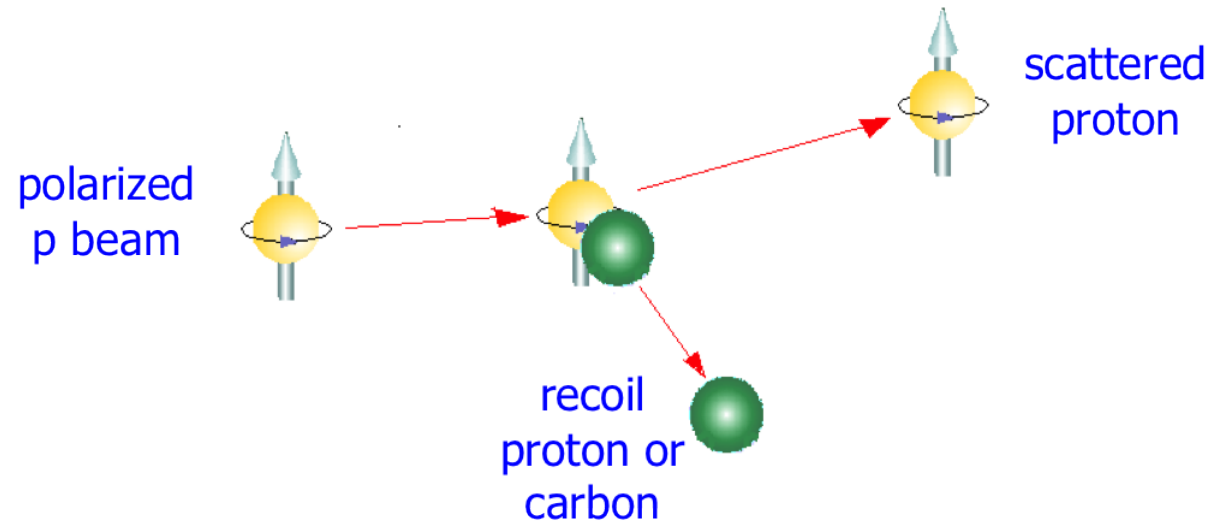
- Analyzing power is calculable for the Coulomb-Nuclear Interference (CNI)
$0.001 < |t| < 0.02 \ (\text{GeV/c})^2$

- In the experiment we measure assymetry ε

$$A_N = \frac{\varepsilon}{P} = \frac{1}{P} \times \frac{N_L - N_R}{N_L + N_R}$$
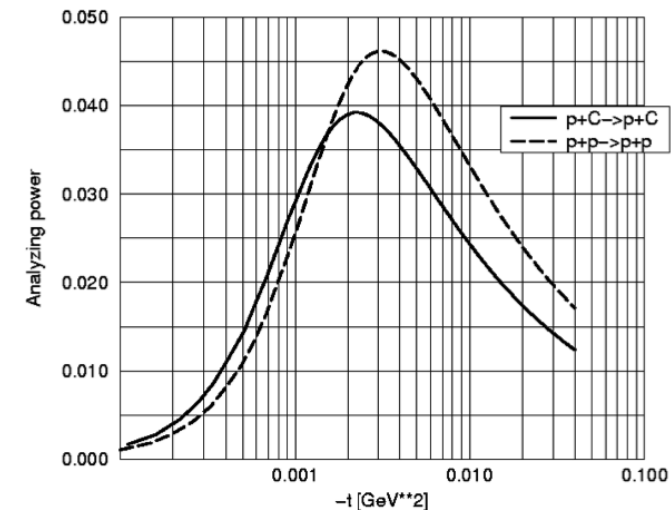
- One dead silicon detector was replaced

- A week ago cleaned the dissociator nozzle and fixed the hydrogen generator

- The jet was cooled and continiously ran for three days with stable target polarization of 96%

- The hydrogen generator failed on January 7 damaging the dissociator

- Reinstalled the generator and the dissociator and applied additional thresholds to shut down the system and prevent damage

- The generator is currently running without cooling to gain confidence in the fixes
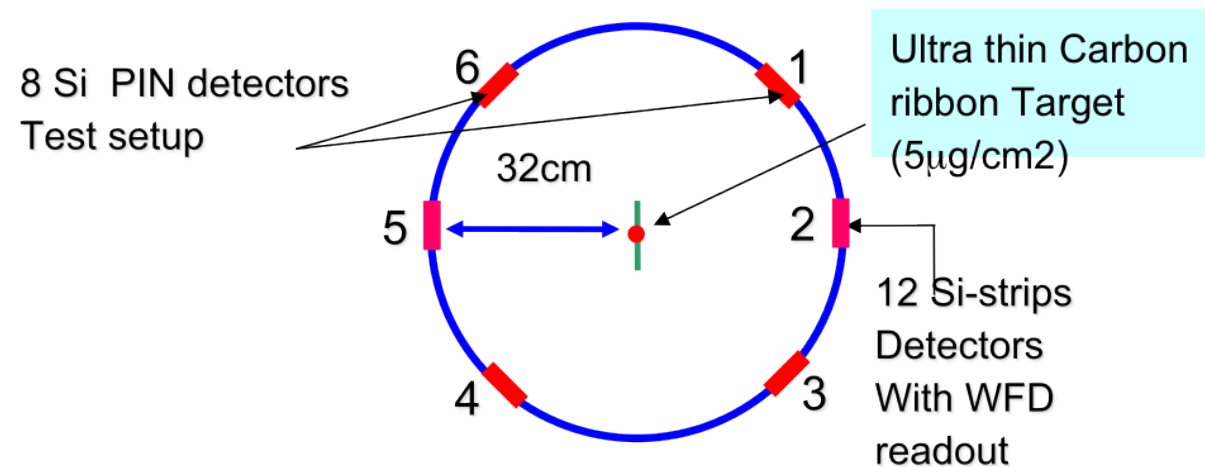
- Two polarimeters (upstream and downstream) in each ring

- Each polarimetr has six vertical and six horizontal carbon targets

- Polarization measurements performed by moving vertical or horizontal targets through the beam

- Measurements every 2-3 hours during a store

p-Carbon Polarimeters in 2011

4 BNL det. @ 45°
new ceramic, improved grounding
2 Hamamatsu det. @ 90°

All detectors:
replaced preamps
Q→I sensitive, faster
10's nS→ ~ 10 nS
reduced pileup

Y1D

Y2U

6 usual BNL det.
presently one det. no signal,
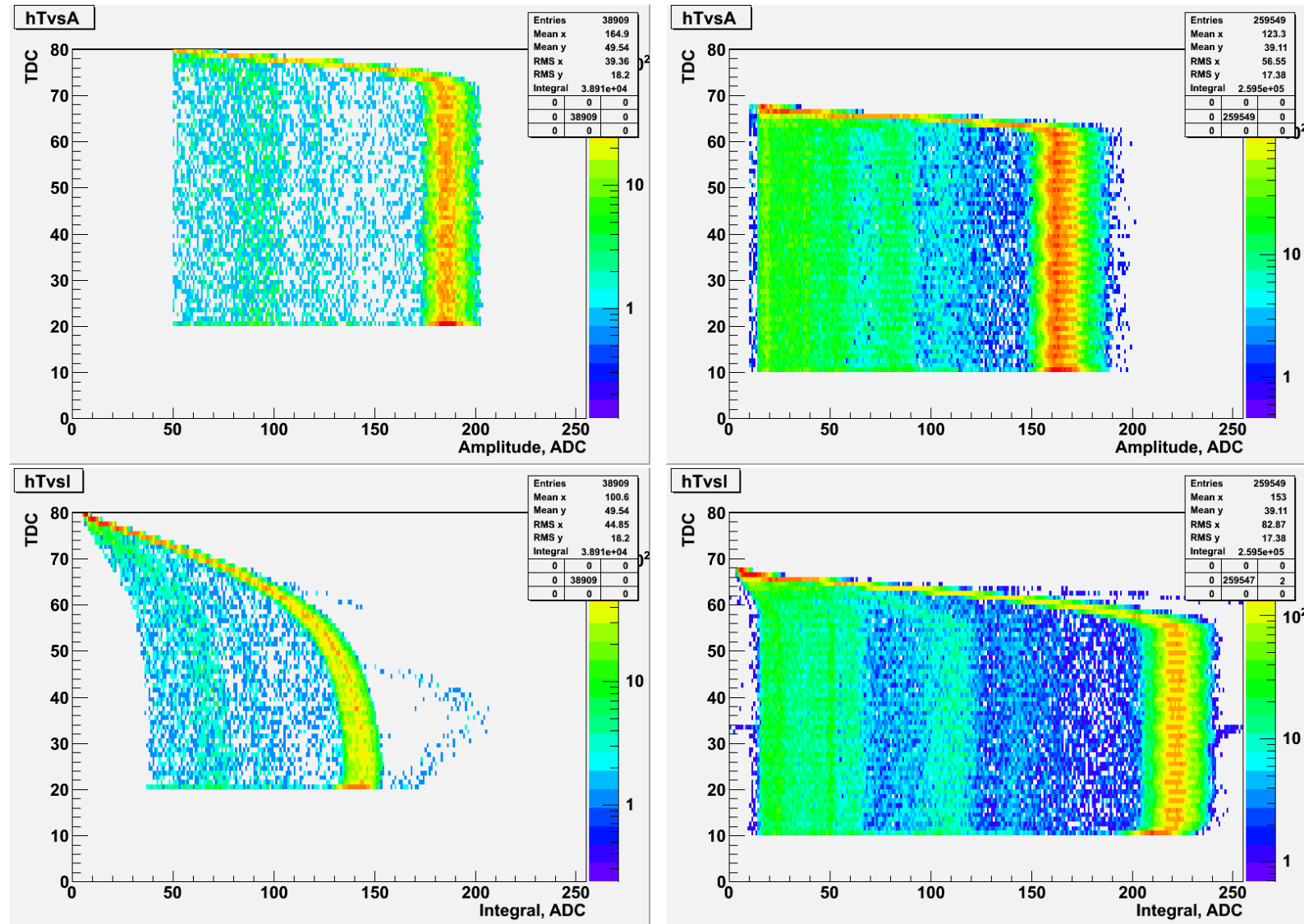bias problem?

B1U

B2D

6 usual BNL det.

4 BNL det. new ceramic
2 Hamamatsu det.
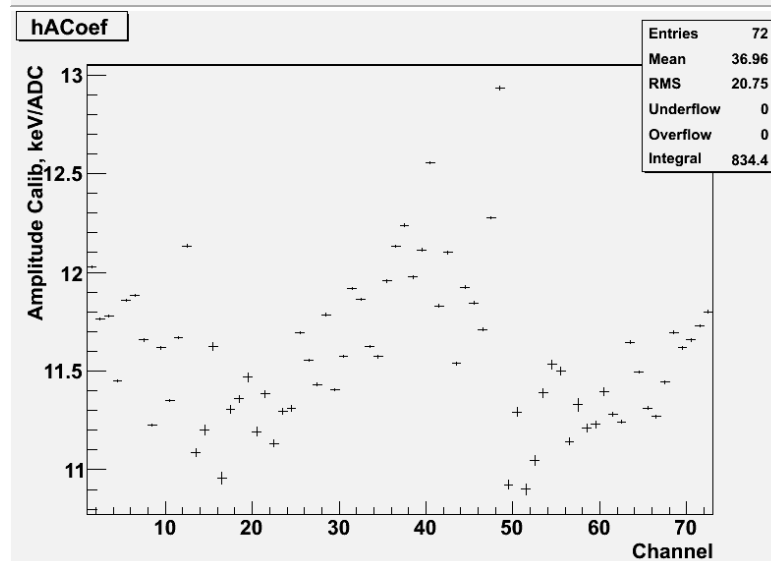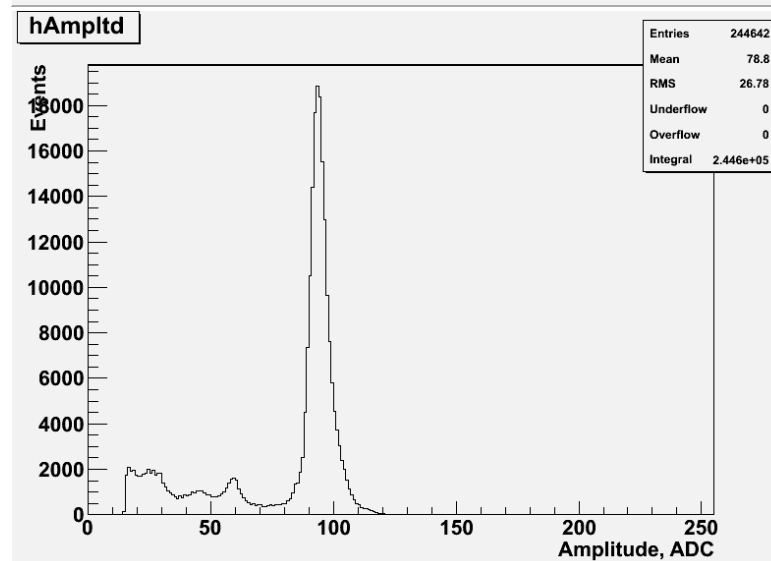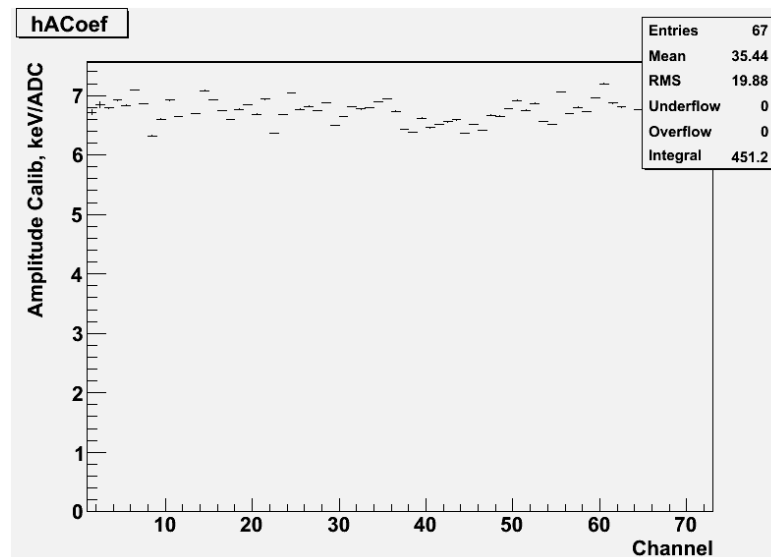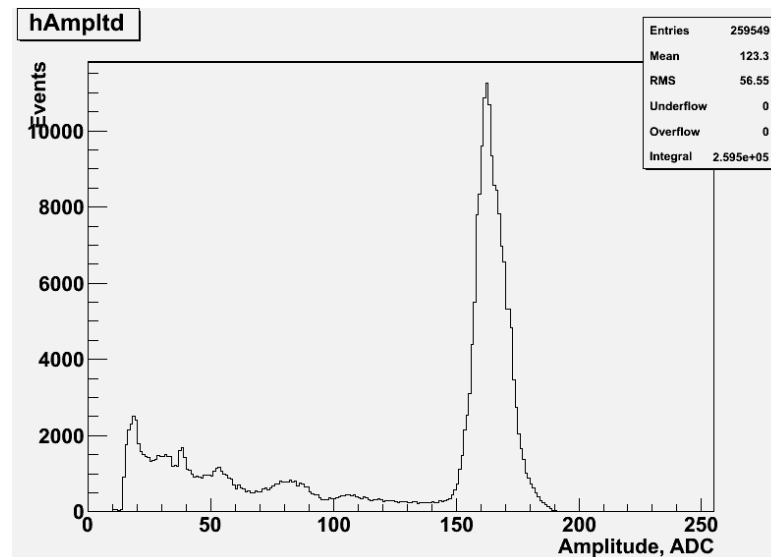
shapers
counting room
DAQ

- Upstream pols. only new preamps
- Downstream: new det./ceramics,
  shorter cable to DAQ, no shapers
  ⇒ reduced pulse degradation

no shapers
tunnel
DAQ

RHIC Spin − January 14, 2011

Dmitri Smirnov

- Left: 2009, Right: 2010
- We have shorter signal in 2011

- Blue upstream (top) and blue downstream (bottom)
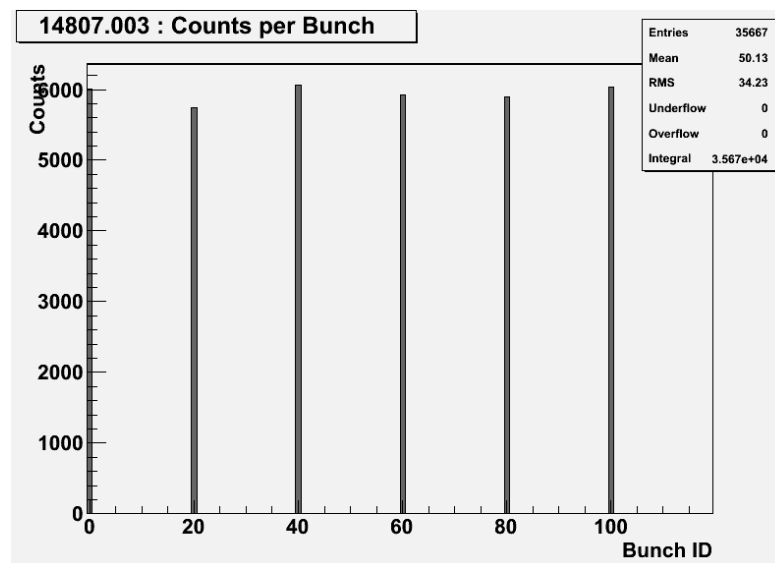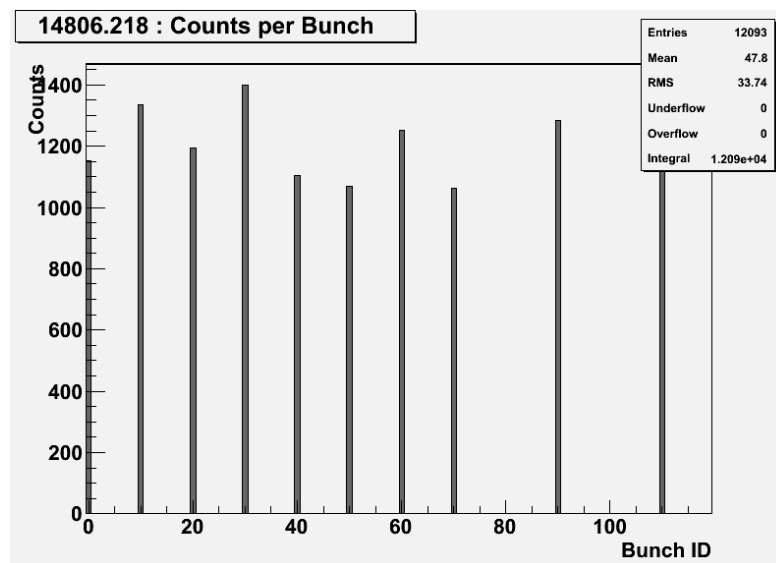- Channel calibration is stable across the channels
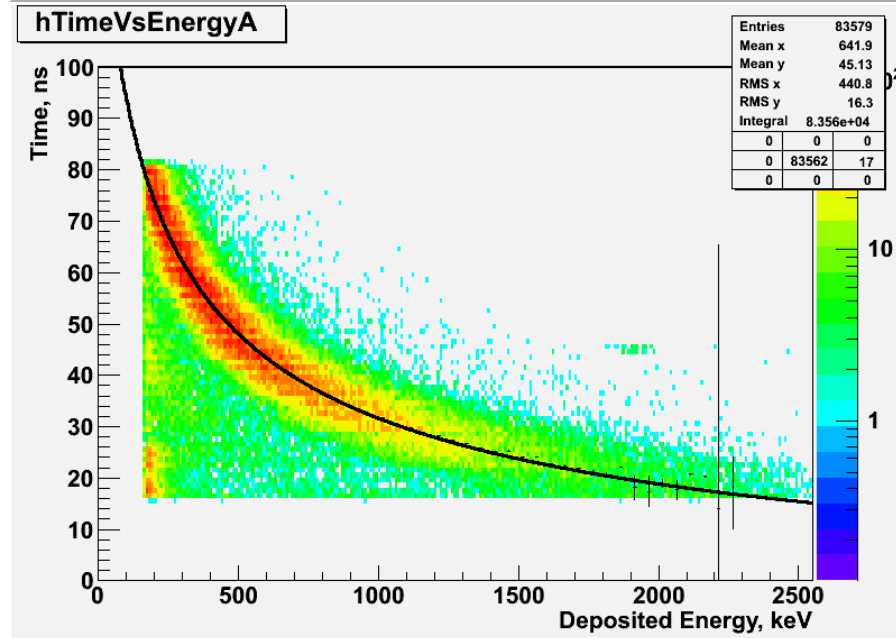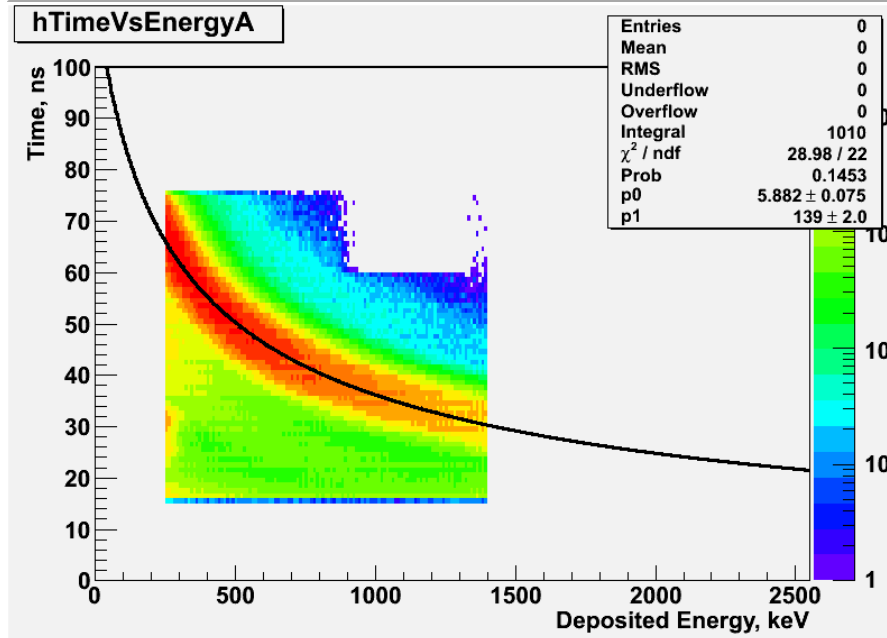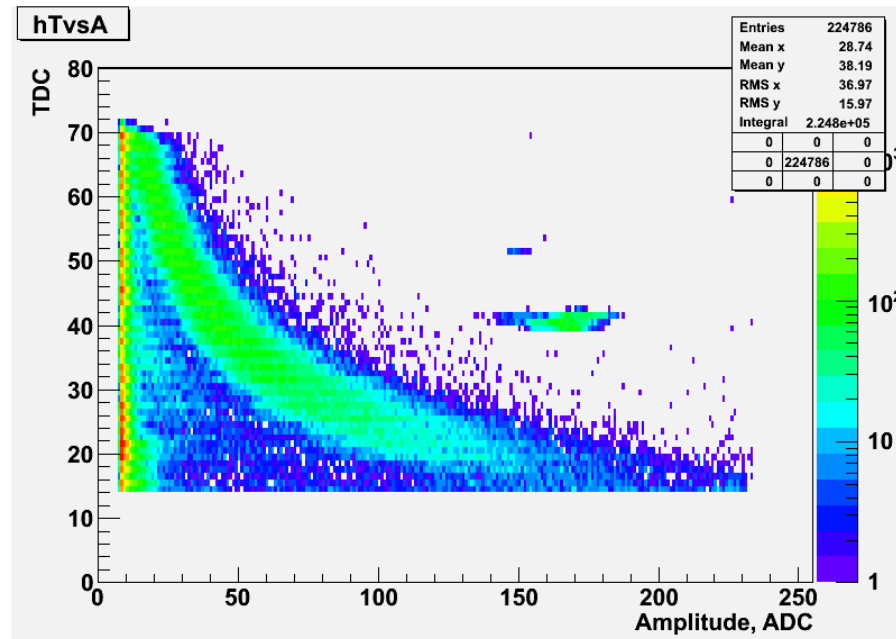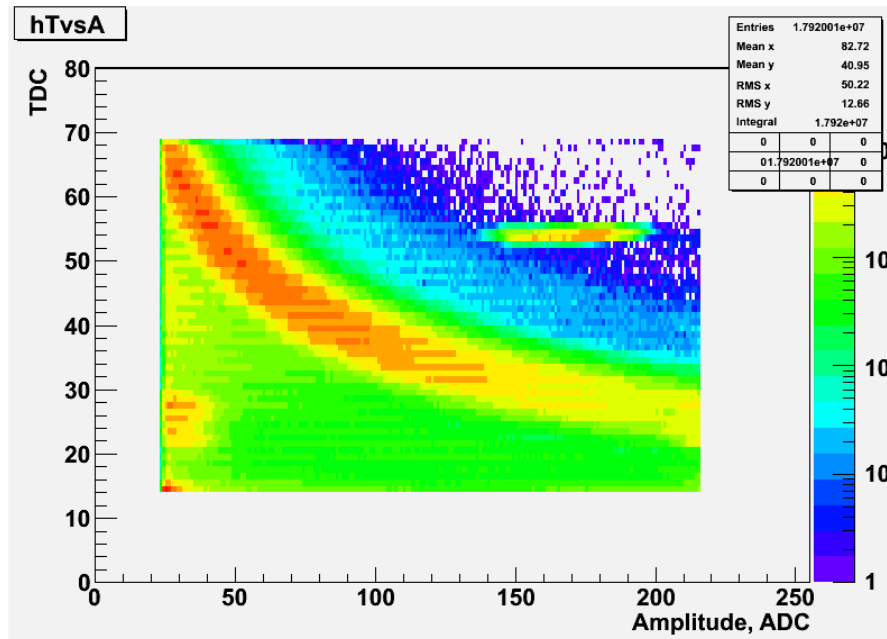
- Blue-2

  - Run 14806.218
  - Horizontal target 1
  - 10 bunches
  - Low energy threshold

- Blue-1

  - Run 14807.003
  - Vertical target 1
  - 6 bunches
  - Increased energy threshold

- Upstream and downstream have different dynamic ranges

- **All p-Carbon and H-Jet detectors have been installed**

- **An effort is made to organize and improve the existing software, both online and offline**

- **p-Carbon polarimeters:**

  - New targets are in place
  - All channels calibrated with alphas
  - Data from test runs is available for blue polarimeters
    - **We see the bananas!**
    - Can calibrate for t_0 and the dead layer
  - Configure the yellow polarimeters

- **H-jet polarimeter:**

  - Take alpha calibration vs silicon bias voltage and balance the individual channel gains
  - Scan the jet horizontally to determine the jet beam width, background, and center on the beam
  - Take data to start offline analysis and determine the dead layer